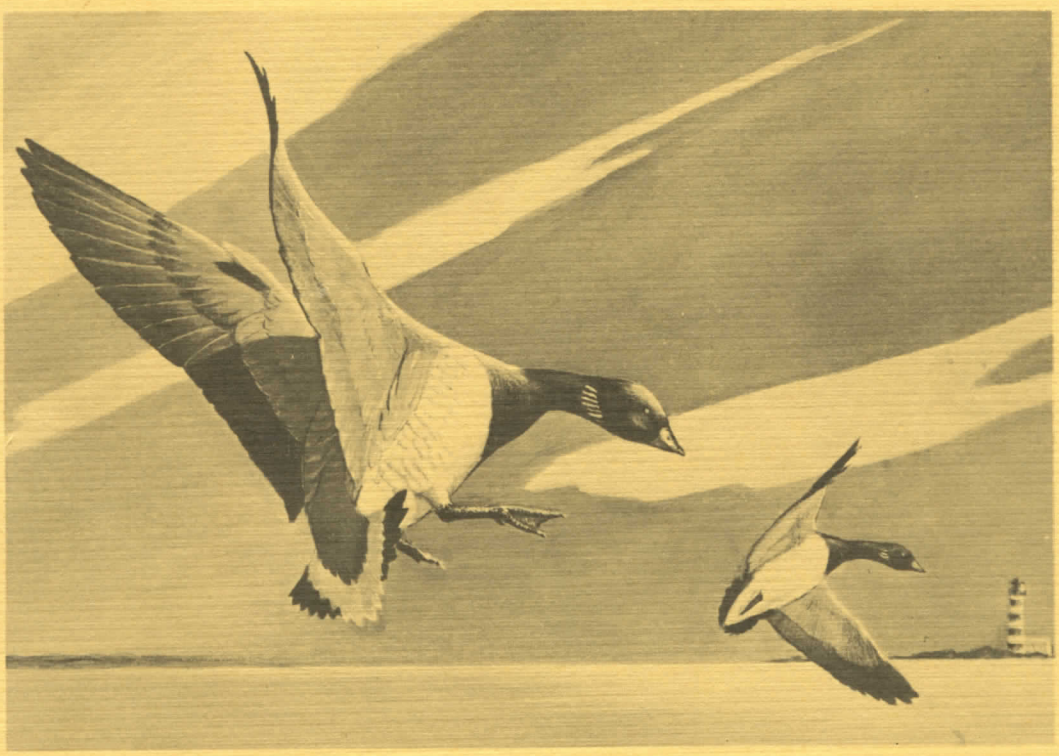
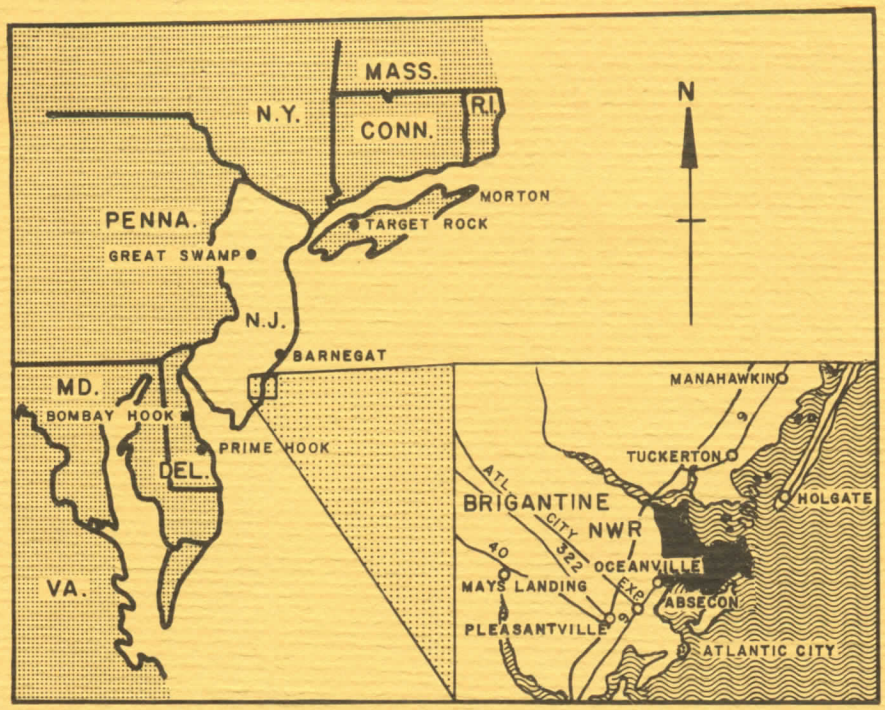
BRIGANTINE

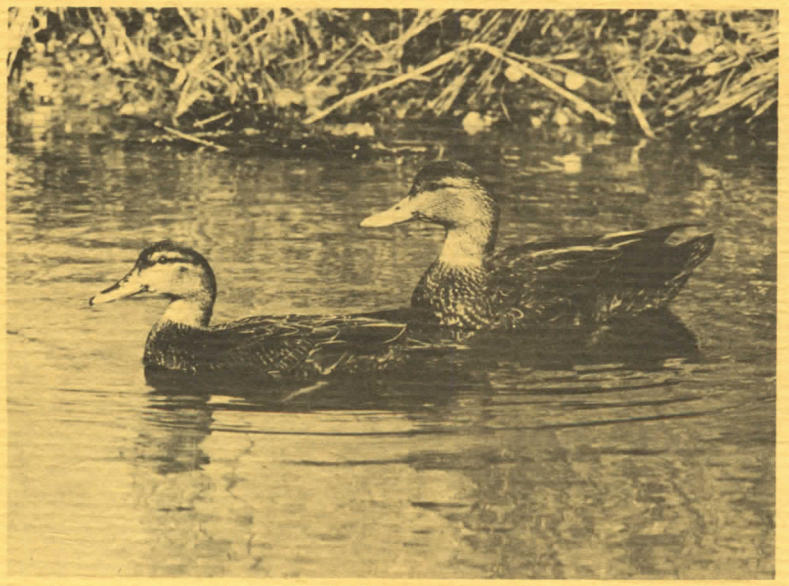
NATIONAL WILDLIFE REFUGE



NEW JERSEY



The Refuge System is a National network of lands and waters managed and safeguarded for preservation and enhancement of the human benefits associated with wildlife and their environments. It presently consists of over 320 units, embracing nearly 30 million acres in 46 states. About 90 refuges containing 25 million acres in over 30 States qualify for study under the Wilderness Act.



U.S.
DEPARTMENT OF THE INTERIOR
BUREAU OF SPORT FISHERIES AND WILDLIFE
FISH AND WILDLIFE SERVICE

BRIGANTINE
National Wildlife Refuge

MASTER
PLAN

BACKUP
VOLUME

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Bureau of Sport Fisheries and Wildlife

FOREWORD

The material contained herein consists of refuge objectives, operational criteria, proposed development and estimated costs. Information is based on the best available data accumulated during the planning period.

In time, changes in management concepts may require revision of the data contained in this volume. Cost estimates for complex proposed developments will require detailed site planning, involving further study, field surveys and design preparation.

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REVISIONS

Date	Subject	Remarks

CHAPTER I

INTRODUCTION

Brigantine Refuge, located in southeastern New Jersey, is one of the vital refuges along the Atlantic Coast. Areas such as Brigantine Refuge become more and more valuable as industrial and residential pollution and encroachment destroy tidal marshes at an ever-increasing rate, especially along the New York and New Jersey coastlines.

The refuge was established on October 5, 1939, with the initial acquisition of 1,768 acres. The Migratory Bird Conservation Commission under authority of the Migratory Bird Conservation Act approved acquisition of 21,864 acres, of which 19,388 acres have been acquired.

The refuge is located within a traditional nesting, migration, and wintering area for waterfowl, marshbirds, and shorebirds. It is the major wintering ground for Atlantic brant and is one of the important wintering and migration areas for the black duck.

The topography of the refuge is typical of the coastal marshes of New Jersey, where uplands taper gradually to a wide band of salt marsh, terminating in open shallow bays. These bays are separated from the ocean by barrier beaches protecting the refuge marshes from direct wave action. The firm, deep, dark-colored, clayey much supports a good growth of salt-marsh grasses (Spartina spp.). The elevation of the refuge ranges from six feet below mean sea level to 50 feet above mean sea level. The elevation of the tidal marsh averages two feet above mean sea level, and normal tides average 4.5 feet.

Average annual precipitation is 42 inches, including 14 inches of snowfall. Average annual temperature is 54°F with a January average of 36°F and July-August averages of 73°F. Average annual evaporation is 33 inches. The area is subject to periodic "nor'easters" in early spring with heavy rains, high winds, and flood tides. Every few years the same storm conditions are experienced in the late summer and early fall by the remnants of hurricanes spawned in the Sargasso Sea.

Direct precipitation and two small watersheds provide water for the two freshwater pools of 535 and 900 acres. The tides, two rivers, and shoreline springs nurture the rich estuarine environment which is the keystone of the biological, educational, and recreational potential of the refuge.

CHAPTER II

OBJECTIVES

The following objectives serve as guidelines for management and development of the Brigantine National Wildlife Refuge. These biological, educational, and recreational goals are based upon the ecological and physical potential of the refuge. These objectives listed in order of priority will be to:

1. Preserve and manage the wetlands environment for waterfowl, shorebirds, and other wildlife as production, migration, and wintering habitat.

   Brigantine Refuge was established to preserve a traditional wintering and migration area of the Atlantic brant and the black duck.

   The estuarine habitat in and around the refuge winters 80% of the East Coast brant population, and about 10% of the Atlantic Flyway's black duck population. This habitat also serves as both migration and breeding habitat for a host of shorebirds, water birds, and waterfowl of numerous species. Vital as a marine nursery and nutrient pool, this intertidal environment is scheduled for a review as a potential area to be included in the National Wilderness Preservation System. The designation of this area as a Wilderness by Congress will help to insure its protection from pollution and encroachment.

   Two freshwater pools totaling 1,435 acres, developed within the salt marsh, have increased the capacity of the refuge migration and nesting habitat, and help to compensate for similar habitat that is being lost at an ever-accelerating rate along the New Jersey coast. The broad expanses of shallow water and flats of the 900-acre West Pool in particular have provided excellent habitat for large concentrations of migrating shorebirds.

   Brigantine Refuge is renowned as one of the most outstanding areas for observing spectacular concentrations of varied bird life along the northeast coast. Thousands of people visit the refuge annually to view this striking display of nature.

The ducks produced on Brigantine Refuge contribute to the Atlantic Flyway population and help to satisfy the public demand for the consumptive and non-consumptive use of the resource on the refuge and within its area of influence.

The current annual production of about 4,000 ducks is concentrated in the 535-acre East Pool. Predominant nesting species are the black duck, gadwall, blue-winged teal, and mallard. Management of this pool to maintain this level of production will provide optimum habitat for the many species of water birds common to the New Jersey coast.

Studies on the refuge have shown that mammalian predation, especially raccoon and fox, is a limiting factor of duck production. This predation can be reduced to help achieve optimum wildlife values.

Sustaining the duck-nesting habitat in the East Pool will also benefit Canada goose production. The resident goose flock annually produces about 600 goslings which provide for visitor observation opportunities, a source of transplant stock, and a supplement to local hunting opportunity.

2. Perpetuate existing habitat that is found to benefit rare or endangered species.

The pine barrens tree frog and bog turtle are present in swamp and bog habitat near the refuge. A small area of similar habitat on the refuge where this amphibian and reptile may be present has been designated a Research Natural Area.

The American osprey nests on Little Beach Island, Elder Island, the Holgate Peninsula and along the upland edge of the refuge. Little Beach and Little Egg Islands are designated Research Natural Areas and are included in the area that contains potential wilderness resources that meet the basic criteria as contained in the Wilderness Act (Public Law 88-577). Studies are under way to determine whether the refuge (or a portion of it) should be recommended for inclusion in the National Wilderness Preservation System. Preserving the solitude and isolation of these islands and minimizing human disturbance contribute to the greater nesting success of the osprey.

Bald eagles and peregrine falcons use the refuge during the fall and winter periods. Brigantine Refuge benefits the eagle and falcon by providing a favorable environment with minimal disturbance.

3. Provide environmental-education and wildlife-oriented recreation programs and facilities to the public.

   The refuge is located in the most densely-populated state in the nation, within easy driving distance of the urban populations of the New York-Philadelphia-Washington, D. C. megalopolis. It is adjacent to the Atlantic City resort area that attracts 6.5 million visitors annually. Refuge visits exceeded 135,000 in 1969. Of the 135,000 total visits, swimming and saltwater fishing accounted for approximately 77,000 use days.

   An anticipated 200,000 people will visit the refuge annually by 1975. Approximately 100,000 of these visitors can be accommodated by existing and proposed wildlife-oriented, non-consumptive, recreational programs and facilities without damage to the environment or diluting the quality of the visitor's experience. The remaining 100,000 visitors will be hunters, saltwater fishermen, and swimmers.

   Planned parking facilities will help limit the number of visitors using the environmental-education building and the associated wildlife trails. A permit system will zone the use of the tour route when necessary.

   The close proximity of the tidal bays, mud flats, salt marsh, uplands, and impoundment habitats and their availability to the public provide a nearly ideal juxtaposition and diversity of ecological types for an optimum mix of wildlife and human benefits.

4. Encourage scientific study and research by qualified organizations and individuals.

   The abundance and diversity of flora and fauna within the different environments of the refuge provide an ideal outdoor laboratory easily accessible to the many nearby colleges, universities, and other scientific institutions.

CHAPTER III

OPERATIONAL CRITERIA

I. Water Management

Doughty Creek, direct precipitation, runoff, springs, and seeps are the sources of fresh water that supply the two existing refuge impoundments that total 1,435 acres. In years of average precipitation this water supply is barely adequate to meet summer requirements. An additional water supply and improved water control facilities would permit maintaining high quality aquatic habitat during years of below-average precipitation and thus sustain the objectives relating to waterfowl production and migration, wildlife-oriented recreation, and environmental education.

All dikes should be maintained to the extent necessary to protect the excellent waterfowl and shorebird habitat which has been developed by the Bureau. These dikes are periodically mowed to control weeds and maintain nesting and feeding habitat for waterfowl, and should be sloped to permit safe mowing with farm tractors. This practice also improves the wildlife observation opportunities for the public using the tour route located on perimeter dikes.

West Pool

Doughty Creek enters the southwest corner of this 900-acre impoundment. Water may be discharged through the West Pool structure into the bay by gravity or by pumping and/or gravity into the East Pool through the Cross Dike control structure.

Although some nesting occurs in this pool, the most benefits will be realized by managing the pool to provide:

1. Resting and feeding habitat for:
   a. Waterfowl in fall and early spring.
   b. Shorebirds in late spring.
2. Brood habitat for waterfowl during mid- and late summer.

To optimize the potential of this pool and to realize these objectives will require:

1. The capability to introduce salt water periodically to control emergent vegetation and stimulate desirable aquatics.

2. Cleaning major ditches which have silted in for efficient collection and distribution of fresh water.

3. Meeting the parameters as outlined in Table A.

Table A

Parameters of Water Management Capability

Nov. 2 - Nov. 17.	Lower to just below marsh level (1.8 msl).
Nov. 18 - Mar. 10.	Maintain at 1.8 msl to prevent ice-scouring of vegetation and maintain the marsh habitat of Doughty Creek above the West Pool.
Mar. 11 - Apr. 1.	Raise to 2.5 msl for feeding and resting habitat for migrant waterfowl.
Apr. 2 - Apr. 15.	Lower to just below marsh level (1.8 msl).
Apr. 16 - June 30.	Maintain for shorebird feeding habitat and stimulate growth of waterfowl foods.
July 1 - Aug. 15.	Gradually raise water level to 2.5 msl concurrently with growth of waterfowl foods.
Aug. 16 - Nov. 1.	Maintain 2.5 msl for feeding and resting habitat of migrant waterfowl and brood habitat for birds from the East Pool.

East Pool

The freshwater supply for this 535-acre pool is overflow from the West Pool through the Cross Dike structure plus precipitation. These sources are seasonally inadequate. Currently this impoundment provides nesting habitat of Spartina grasses, with 90 per cent of the refuge's annual waterfowl production occurring here.

To sustain the productivity of the nesting and breeding-pair habitat of this pool, it will be necessary to provide improved water level flexibility. This will require:

1. The capability to introduce, drain, and maintain salt water and fresh water per Table B, and

2. Cleaning all ditches of silt; the spoil to be spread at intervals along the ditches not to exceed six inches in height.

Table B

Parameters of Water Management Capability

Feb. 15 - Feb. 28.	Maximum drawdown of salt water.
Mar. 1 - Mar. 15.	Exclude salt water. Flood with fresh water to 2.10 msl for breeding-pair habitat.
Mar. 16 - Aug. 1.	Maintain no greater than 2.10 msl for nesting and brood cover and maintain any salinity of sea water we feel necessary between 0%-20% to maintain salt-marsh grasses.
Aug. 2 - Feb. 14.	Exclude and draw down fresh water; introduce salt water. Top meadow with spring tides (3.00 msl) when possible; control ebbing and flowing of salt water remainder of time. Maintain as near bay salinity as possible to perpetuate the Spartina grass habitat.

II. Land Use Management

A. Grasslands

Approximately 107 acres of existing grasslands are managed to provide:

1. Seasonally-succulent browse for resident geese;
2. Nesting cover for waterfowl and other birds, and
3. Browse for wintering brant during prolonged periods when bay cabbage is covered with ice.

This acreage includes 42 acres of grasslands on dike slopes and 65 acres of upland fields adjacent to the West Pool. These grasslands will continue to require applications of lime and fertilizer, reseeding, chemical control of weeds, and mowing. No engineering services will be necessary.

B. Economic Use

Haying will be considered when surplus grasses are produced. Fur trapping will be used as a management tool to help increase waterfowl production. The refuge--acting as a buffer to pollution, dredging and filling--will continue to produce shellfish for harvest by area residents.

III. Service Facilities

A. Buildings - Operations Area

The refuge office and headquarters residence were constructed by the CCC in the '40's. Office facilities are adequate at present, but will need eventual replacement.

Office space will be required in the future for the following personnel: refuge manager, assistant manager, student assistants, refuge biologist, and clerk-receptionist. Space should be provided for a small lobby and a conference room for a staff of up to 10 people. Rest rooms and storage space should also be included. The building should be heated electrically and designed to blend harmoniously with the surroundings and other buildings.

Adequate work space requirements can be met by an addition of approximately 720 square feet to the present shop building. Locker and toilet facilities for a maintenance staff up to 10 permanent and temporary people should be included. An unheated storage building with graveled floor, of approximately 1,500 square feet for materials and supplies, such as wooden signs, farm implements, tools, boat trailers, etc., will meet storage needs. It should be similar in construction and design to the recently built steel equipment building and should have four, 12-foot wide, overhead doors and one standard walk-in door.

The residence at headquarters will be retained for personnel subject to transfer. A complex of five refuge buildings (RP Nos. 25-29) are utilized under Special Use Permit by the New Jersey Department of Conservation and Economic Development as a marine fisheries laboratory for research on the salt marsh and estuarine environments. These buildings will be retained.

All other buildings not vital to the operation of the refuge will be disposed of as time and fiscal resources permit and as ownership irregularities are resolved.

B. Roads and Trails

An asphalt-paved entrance road from the end of Great Creek Road to the proposed environmental-education building parking lot will be required to accommodate intensive visitor use. It should present an aesthetically pleasing and natural approach. The paved parking lot should have a capacity for at least 100 cars and 6 buses. When the intensity of visitor use warrants it practical, an auto-glide tour route should be considered. Paving the present eight-mile, graveled tour route will safely accommodate a concessionaire-operated, auto-glide unit--similar to the one proposed for Great Swamp Refuge.

In the interim, the auto-tour will require widening and graveling where needed to maintain a safe, smooth, firm road of 18 feet with two-foot shoulders.

C. Fences

Standard boundary fencing will be installed to prevent encroachment of private use on refuge property. A 12-foot-wide strip is cleared along the fence line, and vegetation controlled to maintain a 10-foot-wide trail for boundary patrol and maintenance. Approximately ten miles of fencing will be required when acquisition is complete.

D. Posting

All boundaries, including both sides of public roads, will be posted at approximately 1/10-mile intervals. Approximately ten miles of boundary will require posting.

E. Plot Plans

Public Use Area

An environmental-education building should be located adjacent to the gravel pit pond and overlook the West Pool. Landscaping will be required.

Operations Area

The proposed storage building should be located across the court west of the present equipment building. The new office building should be located 75 yards south of the present office. The existing residence should be screened by landscaping from the Operations Area.

IV. Utilities

Existing telephone service and single phase power are presently adequate. Three-phase electricity is available nearby. Power and telephone lines will be underground.

V. Public Use Facilities

An environmental-education building should include space for interpretive displays and exhibits, visitor reception and information, auditorium with projection equipment, storage and repair space for exhibits, administrative offices, and rest rooms. The building should be designed to harmonize with and complement the surrounding environment. Asbestos roofing and fire-resistant exteriors are required to prevent possible damage during frequent forest and brush fires in the area.

The estimated visitor load is at least 100,000 people annually with peaks of up to 700 persons daily. The proposed staff that would need office space would be: a public use specialist, three naturalists, a clerk-stenographer, and a law enforcement guard.

The present tour route will be re-routed to start from the parking lot, thus separating the public use area from the operations area. Wildlife trails, including boardwalks, will emanate from the environmental-education building, follow along the marsh edge, and connect with other upland nature trails. An interpreted wildlife trail will be built through the old burn area on Tract #303. A two-way graveled road from the present tour route will provide access to a four-table lunch area and a ten-car graveled parking lot located in the vicinity of the former Division of Engineering field station.

Additional photo blinds will be provided along the perimeter of the marsh. The boat-launching facility at Landing Creek will be improved to double its present capacity.

Public use facilities are not planned for the Holgate Peninsula as they are provided by private interests adjacent to this area. Refuge personnel will continue to provide control during high visitor use periods.

CHAPTER IV

DEVELOPMENT

From 1940 to 1952 the refuge development consisted of the establishment of the operations area and miscellaneous other facilities. The period from 1952 to 1960 saw the construction of dikes and water control structures for large impoundments, the West and East Pools. From 1960 to date, repairs to the dikes and structures have been made as necessary after storm tides and high winds.

In 1960 a boathouse was constructed and in 1964 an experimental pool was impounded within the West Pool. Boat ramps, parking areas, a new equipment building, observation towers, fences, and miscellaneous improvements were accomplished during the 1960-1970 period.

Proposed improvements in the operations area are shown on the plan on page 33 . A considerable part of the proposed developments are improvements to the existing facilities.

The present office is in the old service building, constructed in 1940. The office consists of two rooms and a toilet. The garage portion of the service building has been converted to an auditorium. A new office building to replace the present office is proposed in the plan.

The service building will be modified to provide additional housing and storage.

The proposed office will have a floor area of about 1,500 square feet and have a complete new set of utilities.

The existing residence and garage will be retained. The comfort station and information building will be removed.

An addition is proposed to the existing shop building. This addition will have a floor area of about 720 square feet. Lockers and toilet facilities will be included in the addition.

A new unheated storage building near the existing equipment building is also proposed. Floor area of the building will be about 1,000 square feet.

Public Use Areas

An environmental-education building with a floor area of about 4,000 square feet and a parking area of 40,000 square feet will be located adjacent to the gravel pit pool, overlooking the West Pool north of Great Creek Road and the office.

Interpreted trails will be located throughout the uplands originating from the environmental-education building area.

The lunch area west of the experimental pool will be improved, including an entrance and exit from the tour road.

An existing boat-launching ramp and parking area at Landing Creek will be reconstructed and expanded.

Roads and Trails

The existing self-guided tour route on the top of the dikes will be improved by regrading of the dike.

The tour road west of the West Pool off the dikes will be widened, and surface drainage will be provided. An entrance into the environmental-education building parking area will be constructed from the end of Great Creek Road.

Both the entrance road and the parking area at the environmental-education building will be paved. The auto tour route will be paved when the traffic density requires this improvement.

Cross sections and details of road construction are shown in the proposed plan on page 34 .

Patrol roads will be at critical locations along the boundary fence and used for policing and access by maintenance vehicles. Access ramps for maintenance vehicles and for boat-launching from the dike roads will be constructed.

Topography

On-the-ground topography was taken in 1930 and the plotted results are on file in the office of the Division of Engineering in Boston, Mass. The topography is of the marsh area and shows spot elevations below Elevation 6 msl.

Impoundments

Additional impoundments are not proposed in the development plan.

The perimeter dikes impounding the West and East Pools will be re-graded and brought up to shape as shown on the drawing.

The dikes were constructed in the '50's. Fine, sandy gravel available on the refuge was used as the core, and the slopes are protected with the organic materials excavated from borrow ditches along the dikes.

Settlement of the dikes has always been a problem as has erosion by storms. The dikes have been overtopped and damaged during these storms, and the pools have been filled with sea water on occasions.

The dikes were constructed on marsh muck by end-dumping. It has been reported that as much as 100 cubic yards were dumped in some areas for one linear foot of dike. This was during initial construction. After construction, settlement continued and more fill was added. Three water control structures were installed after dikes were in place.

Originally, two 48-inch corrugated metal pipes were installed in the south dike of the West Pool. This structure was damaged because of subsequent hauling operations during construction of the cross dike.

After numerous other troubles, including visible evidence of corrosion by the salt water, this structure was replaced with two 42-inch asbestos cement pipes. The two 48-inch tide gates were left in place on the bay side with the corrugated metal pipes. Double stoplog bays were retained in the West Pool for water control.

The cross dike separates the East and West Pools and the flow between the two is provided by two 36-inch corrugated metal pipes. Double stoplog bays are provided at both ends of the two pipes for water level control.

A 4-foot by 4-foot concrete box structure provides drainage for the East Pool. Leakage under and around this structure was discovered after construction, and a steel sheet cutoff wall has been installed in the pool to help prevent excessive water losses.

The East Pool structure has two flap gates on the bay side and two stoplog structures for pool water control on the pool side.

All three structures were set on timber piles varying from 12 feet to 40 feet in length with timber sheet piling installed in the center of the dike to act as a cutoff wall.

Proposed Impoundment Improvements

In order to meet the criteria of flooding the East Pool with bay water, a new 4-foot by 4-foot concrete box culvert is proposed in the East Pool dike. The structure will have the tide gate in the pool and a slide gate on the bay side. While the existing structure can only be used to drain the pool, the proposed structure will allow only bay water to enter the pool.

The internal drainage ditches within the pools will be cleaned and dredged approximately to Elevation 1.5 or about 0.5 feet below their present grade.

The borrow ditches inside the perimeter dikes will be cleaned, deepened and widened, and the spoil used to make up any deficiencies required to shape up the existing dikes to their proposed cross section.

A band ditch is proposed in the West Pool area near the edge of the marsh to intercept ground water flow and to provide drainage for this area. At present, there are no provisions for draining this area adjacent to the uplands.

Water Supply and Requirements

The main freshwater supply for the impoundments is the runoff from Doughty Creek and the uplands adjacent to the West Pool. The combined drainage area of the creek and the uplands is about 2,900 acres. West Pool area is about 900 acres and the East Pool, about 500 acres.

Area capacity curves for the two pools are shown on page 32.

The estimated average yield from the 2,900 acres of uplands varies from 654 acre-feet in March to 264 acre-feet in November. This yield or runoff enters the West Pool. Freshwater supply to both the West and East Pools is supplied by this runoff plus precipitation within each pool area.

A program for filling the East Pool with bay water has been proposed in the Operational Criteria. The bay water will enter the East Pool through the proposed new structure. Filling of the East Pool with

saline bay water commences about the first part of September and is to be filled to about Elevation 3 in October.

During the period from October to the middle of February, the East Pool will remain near Elevation 3 with saline bay water. Fluctuations due to the ebbing and flooding of the tide will be held at a minimum by the proposed control structure. Excess bay water can be released during periods of low tides if it becomes necessary. Drainage of the saline water will commence in February and the drawdown completed by the first week of March. The existing East Pool structure will serve as the drain.

During the remainder of the year (March to August, inclusive) the East Pool can be flooded with fresh water either by gravity flow or by pumping from the West Pool.

The management levels of the East Pool and of the West Pool are graphically shown on Page 35 .

When the East Pool level is maintained by pumping from the West Pool, the projected level of the West Pool will not be possible to hold under less-than-average conditions of runoff, and supplemental fresh water will be required.

It is anticipated that a limited amount of additional fresh water can be obtained from wells. An item for well exploration and all facilities to obtain the additional fresh water is included in the cost estimate, as well as the pump to exchange water from the West to the East Pool.

Water Rights

The Riparian Doctrine applies to the surface water rights in the State of New Jersey. The State Water Policy Commission has general authority to supervise the use and development of all waters of the State and to regulate construction of dams.

In 1947 the state legislature extended the control of ground waters to all private, domestic, and industrial supplies, and permits are required for new diversions of ground water in excess of 100,000 gallons a day. In 1962 the state legislature extended the control to surface waters, and permits are required for new diversions of more than 100,000 gallons a day.

Since the Riparian Doctrine applies to the surface water rights in the State of New Jersey, the rights we have to the flow of Doughty Creek are neither more nor less than the rights other riparian owners may have.

The demand for well water is expected to vary from a maximum supply of 1,600 gallons a minute to an average supply of 225 gallons a minute.

The explorations may find that these amounts are not available because of local demands for ground water.

The maximum water supply diversions for the refuge are in excess of those permitted by the state without a special permit.

A permit for the maximum demand would be required and filed if ground water could be obtained without depleting local domestic supplies.

Utilities

The nearest fire department is in Oceanville, just west of the refuge.

Three-phase power is available at the schoolhouse on Route #9, about one mile south of Oceanville. Electrical service lines to the proposed facilities will be located underground.

No tests have been made at either the site of the public use area or the operations areas for location of new leaching fields.

All utilities including a domestic well are available at the operations area.

CHAPTER V

LAND STATUS

The Brigantine National Wildlife Refuge was established on October 27, 1939 through acquisition of 1,768 acres of land authorized by the Migratory Bird Conservation Act. At present the refuge contains 19,388 acres with another 330 acres under option.

In 1963 the Township of Galloway expressed concern about the loss of taxable property, particularly road frontage suitable for residential and commercial development. As a result, the Bureau agreed to exclude from its present purchase effort all lands west of U. S. Route #9 and land within 1,000 feet of certain sections of roads unless the owner insisted the government purchase his entire tract. The Bureau also agreed that it would offer to exchange any excess land purchased along the roads for other land needed within the refuge on a value-for-value basis.

It is expected that the refuge will be completed with the purchase or condemnation of 512 remaining acres, of which 8.1 acres are on Little Beach Island.

The total estimated size of the refuge when completed will be 20,230 acres, and will have cost an estimated $1,000,000.00.

CHAPTER VI

A. COST ESTIMATES

The following cost estimates are not design or construction costs. They are estimates based upon the best information available at this time. These estimates serve to indicate the magnitude of the proposed item. When detailed site planning is required concrete cost figures will be developed.

These estimates were prepared during the summer of 1970, using the Engineering News Record Cost Index of 1391. This is based on the 1913 Cost Index of 100.

Proposed development should progress in three phases. These phases are related to refuge objectives so that developments will meet demand or priority of objectives in proper sequence.

Phase 1 is directed toward the development of water control facilities needed to sustain the migration and nesting habitat of the West and East Pools. The needed improvements to the self-guided tour route are scheduled in this phase also since the tour route follows perimeter dikes and can be incorporated simultaneously into dike improvements.

Phase 2 contemplates an environmental-education center necessary to accommodate the expected increase in public visitation, and to meet public use objectives. A new office and operations facilities expansion will be necessary by this time to handle the increased administrative and operation functions.

Phase 3 completes the wildlife-oriented recreation proposals with boat-launching facilities and wildlife trails. It may be necessary to pave the self-guided tour route as the increased use could cause deterioration of the environment and lessen the quality of the visitor's experience.

The estimated costs shown include 5% for contingencies and 15% for internal engineering. The environmental-education building estimated cost does not include these added percentages. A separate line item of $51,000 (30%) is shown in detailed site planning to cover costs of internal engineering (15%), specialized planning team (10%), and contingencies (5%) for this large facility.

SUMMARY SCHEDULE (PHYSICAL DEVELOPMENT)

PHASE 1

(TOTAL - $219,000)

Jobs	Planned Units	Estimated Cost
1. West Pool		$65,000
Water Facilities (Includes exploratory wells, tests, 12" pipe line, etc.)	1 each	42,000
Pumps (Cross dike)	1 each	6,000
Ditches		
Clean existing perimeter ditch	16,800 l.f.	15,000
Additional ditching	6,000 l.f.	2,000
2. East Pool		56,000
Water Facilities		
Ditches	170,000 l.f.	26,000
Water Control Structures	1 each	30,000
3. Self Guided Tour Route		98,000
Recreation		
Regrade and widen perimeter dike tops and slopes	29,600 l.f.	85,000
Regrade and widen public use roads	10,400 l.f.	13,000

SUMMARY SCHEDULE (PHYSICAL DEVELOPMENT)

PHASE 2

(TOTAL - $353,000)

Jobs	Planned Units	Estimated Cost
1. Public Use Area		$247,000
Recreation		
Environmental-Education Bldg.	1 each	170,000
Water System (well, pipe)	1 each	6,000
Septic Tank and Drain Field	1 each	30,000
Electric Service	1 each	6,000
Landscaping, Lawns, and Shrubs	1 each	6,000
Miscellaneous Drives, Roads, Walks	2,000 feet)	24,000
Parking Area	36,000 sq. ft.)	
Wildlife Trails	1.5 mile	5,000
2. Headquarters Area		106,000
Buildings		
New Office (1,500 sq. ft.)	1 each	54,000
Shop Addition (720 sq. ft.)	1 each	26,000
Storage Building (1,500 sq. ft.)	1 each	22,000
Utilities and Structures		
Landscaping	1 acre	2,000
Roads and Trails		2,000
Office Parking Area	4,500 sq. ft.	

SUMMARY SCHEDULE (PHYSICAL DEVELOPMENT)

PHASE 3

(TOTAL - $206,000)

	Planned Units	Estimated Cost
1. Leeds Point Fishing Facility		$ 24,000
Recreation		
Expand Boat Launching Facilities	2 each	11,000
Parking Area - Expand and Pave	40,000 sq. ft.	11,000
Rest Rooms (Vault Type)	2 each	2,000
2. Old Burn Recreation Area		9,000
Recreation		
Picnic Units	5 each	2,000
Rest Rooms (Vault Type)	2 each	2,000
Wildlife Trails	1.5 mile	5,000
3. Self-Guided Tour Route		$173,000
Recreation		
Pave Entire Route	40,000 l. f.	173,000

Cost Estimate Summary

Cost Estimates		Total Cost Estimate
Phase 1	$219,000	$829,000
Phase 2	353,000	
Phase 3	206,000	
	$778,000	
Detailed Site Planning and Building Environmental-Education Building	$ 51,000	

BUDGET FUNCTION SCHEDULE SUMMARY

Program Items	Planned Units	Estimated Cost	Phase 1	Phase 2	Phase 3
Water Facilities	Subtotal	$121,000	$121,000	0	0
Ditches	192,800 l.f. (36.5 miles)	43,000	43,000		
Water Control Structures	1 each	30,000	30,000		
Pumps	1 each	6,000	6,000		
Water Supply	1 each	42,000	42,000		
Buildings	Subtotal	$102,000	0	$102,000	0
Office	1 each			54,000	
Shop Addition	1 each			26,000	
Storage Building	1 each			22,000	
Roads and Trails	Subtotal	$ 2,000	0	$ 2,000	0
Office Parking Lot	1 each			2,000	
Structures and Utilities	Subtotal	$ 2,000	0	$ 2,000	0
Landscaping	1 acre			2,000	

SUMMARY (Continued)

Program Items	Planned Units	Estimated Cost	Phase 1	Phase 2	Phase 3
Public Use	Subtotal	$551,000	$ 98,000	$247,000	$206,000
Wildlife Interpretive Trails	(3 miles)			5,000	5,000
Self-Guided Tours and Public Use Routes (Grading, widening, etc.)	(8 miles)		$ 98,000		
Self-Guided Tour Route (Paving)	(8 miles)				173,000
Old Burn Recreation Area	1 each				4,000
Leeds Point Fishing Facilities (Includes two ramps, parking area, and rest rooms)	1 each				24,000
Environmental Education Building	1 each			$170,000	
Utilities for Above (Includes electric service, septic system, landscaping, and water service)	1 set			48,000	
Roads and Trails for Above (Includes parking area, access road, walks, and misc. drives)	1 set			24,000	
Totals		$778,000	$219,000	$353,000	$206,000
Detailed Site Planning	Subtotal	$ 51,000			
GRAND TOTAL		$829,000			

Estimated Operation and Maintenance Costs on Progressive Basis
(in thousands)

	Phase 1	Phase 2	Phase 3
Planning	$ 9.5	$ 14.6	$ 16.7
Detailed Site Planning		51.0*	
Habitat Management	25	30	35
Wildlife Population Management	35	38	40
Public Use Management	35.0	75.0	90.0
Soil and Moisture	3.0	3.0	2.0
	$107.0	$211.6	$183.5

*See Job 1, Phase 2 of Summary Schedule (Physical Development, Page 21)

PROPOSED STAFF

The following professional and versatile staff must be developed concurrently with completion of phases of refuge programs and facilities in order to maximize the outputs of stated refuge objectives. Consideration was given to geographical area, professional balance of required staff, expected benefits and use of the refuge and staff, present and proposed programs and facilities, sequence of development phases, relationship to surrounding rural and urban areas.

The proposed staff assumes the refuge programs and facilities in a completed state with no restrictions or constraints applied.

1. Refuge Manager - overall responsibility for entire refuge. Provides guidelines to assistant refuge manager on policies and procedures. Insures direction of refuge programs and operation is consistent with stated refuge objectives. Alert to any possible shifts in direction which may change emphasis of programs. Suggests modifications or changes of refuge objectives if required. Accompanies visiting governmental, private, and foreign dignitaries on refuge tours acting as refuge and Bureau representative. Establishes and maintains working relationships with state, municipal, and other federal agency leaders. Creates and maintains a favorable station and Bureau image through meetings, TV appearances, press releases, etc. Provides direction and policy in extraordinary circumstances, i.e., oil spills, fires, Congressional inquiries, tort claims, public hearings, etc.

2. Assistant Refuge Manager - responsible for refuge operations and maintenance program. Establishes job priorities and insures smooth functioning and use of all refuge equipment and facilities. Prepares necessary plans and reports for any development and/or maintenance projects. Supervises maintenance foreman, refuge manager trainees, and student assistants. Serves as acting refuge manager when directed or in absence of refuge manager.

3. Clerk-Receptionist - prepares station time and attendance reports, consolidates O & M and development requests and budgets; prepares and maintains personnel documents. Procures and maintains records of suppliers, inventories, and equipment. Types and files reports, plans, memorandums, etc. Serves as receptionist for refuge manager.

4. Refuge Biologist - responsible for preparing and directing all biological plans and reports. Initiates, conducts, and evaluates research projects and wildlife management programs relating to refuge wildlife objectives or ecological requirements. Provides expertise and technical advice to other refuge administrators to assure that all programs are coordinated and that they reflect appreciation and understanding of the environment. Conducts wildlife surveys and censuses, and studies. Prepares plans and reports of same. Supervises land use programs such as soil and moisture, grasslands, water management, fur management, animal control, etc. Cooperates with universities, scientific organizations, individuals conducting wildlife research and/or wildlife management studies.

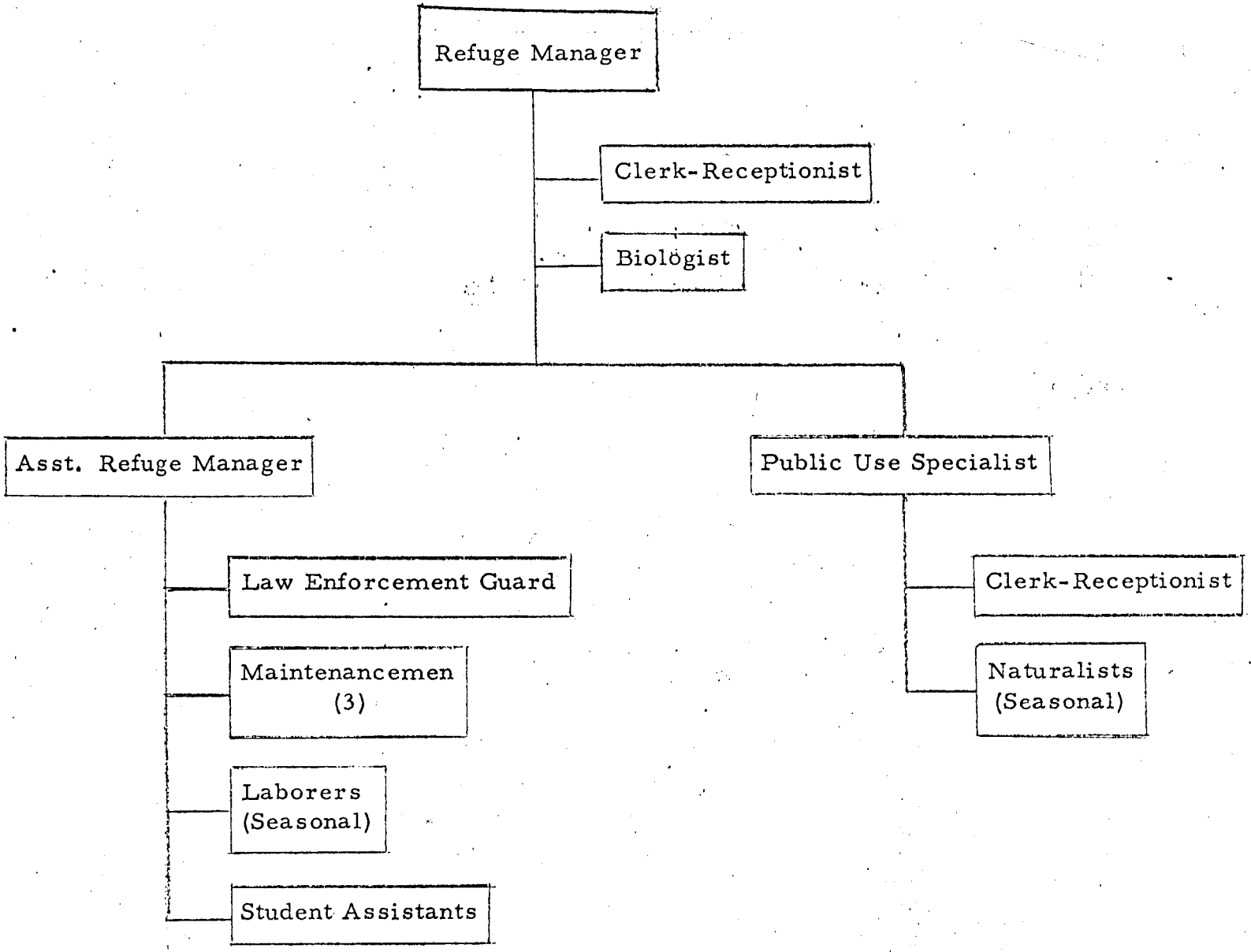
5. Public Use Specialist - responsible for initiating, preparing, coordinating, and evaluating entire refuge public use program. Includes hunting and fishing, interpretive, photography, hiking, sun bathing (Holgate) and wildlife observation programs. Supervises naturalists.

6. Naturalists - (up to 3 seasonal) responsible for taking visitors on guided tours, developing and maintaining high quality, dynamic, interpretive program through exhibits, displays, dioramas, wildlife trails, slide shows, talks, etc., during peak visitor use periods.

7. Law Enforcement Guard - provides protection to people from environment and vice versa. Provides assistance in all phases of public use programs including hunting and fishing, crowd and traffic control. Serves as station safety officer, responsible for developing and implementing a sound pragmatic station safety plan including search and rescue guidelines.

8. Clerk-Receptionist - located in environmental-education building. Performs clerical work for Public Use Specialist and his staff when not acting in receptionist capacity.

9. Maintenancemen - (3) plus seasonal laborers for refuge operation and maintenance, janitorial service, and yards and grounds upkeep of the environmental-education facilities.


Refuge Manager
Clerk-Receptionist
Biologist
Asst. Refuge Manager
Public Use Specialist
Law Enforcement Guard
Maintenancemen (3)
Laborers (Seasonal)
Student Assistants
Clerk-Receptionist
Naturalists (Seasonal)

CHAPTER VII

BENEFITS

A. Tangible Benefits

	Present	Potential
General (hiking, birdwatching, photography, wildlife observations, swimming, sightseeing, etc.)	$ 80,000	$ 130,000
Migratory Bird Hunting	35,000	50,000
Fresh and Salt Water Sport Fishing	64,500	90,000
Commercial Shell Fishing	250,000	1,000,000
Annual contribution to Atlantic, Burlington, and Ocean Counties for public roads and schools (3/4 of 1% of current value of land within project)	10,400	25,000

B. Intangible Benefits

These outputs are those which cannot be assigned a dollar value but nevertheless are the real contributions of the refuge to mankind. Each of the following benefits have value of some degree to most people even though these values may vary according to each person's value system.

TO SOME IT IS A PLACE OF ACTIVITY and AWARENESS for:

Sailing and Surf
Boating and Bass
Waterfowling and Widgeon
Fishing and Flounder
Clamming and Coves
Crabbing and Cordgrass
Photography and Plovers
Looking and Learning

TO OTHERS IT IS A PLACE OF PRODUCTIVITY and PURITY sustaining:

Bay Cabbage and Brant
Marshes and Muskrats
Estuaries and Egrets
Grass and Geese
Open Space and Ospreys
Tidal Pools and Terrapins
Salt Marsh and Shovelers
Shores and Sandpipers
Bulrushes and Black Ducks

TO STILL OTHERS IT IS A PLACE OF PEACE and PROTECTION for:

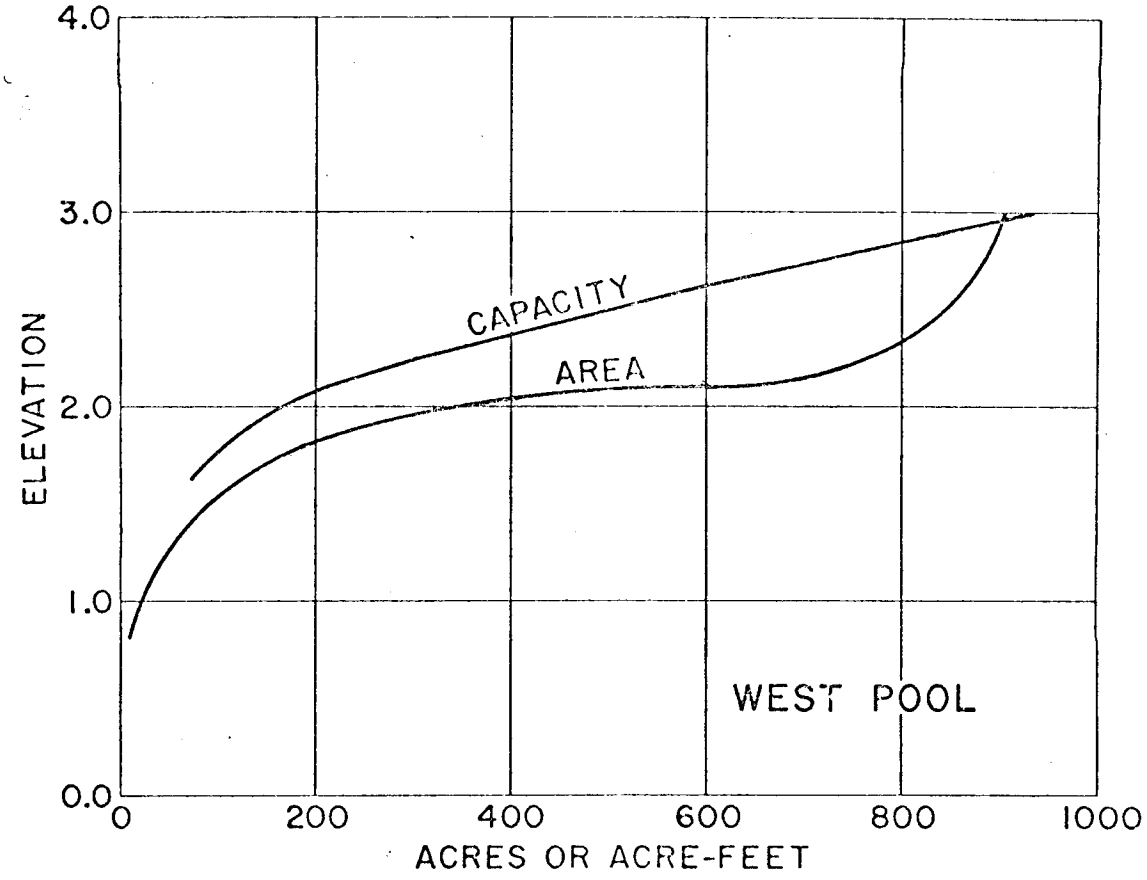
Reflection and Restoration
Sea and Sunsets
Sun and Sand
Breezes and Beauty
Solitude and Serenity
Time and Tranquility

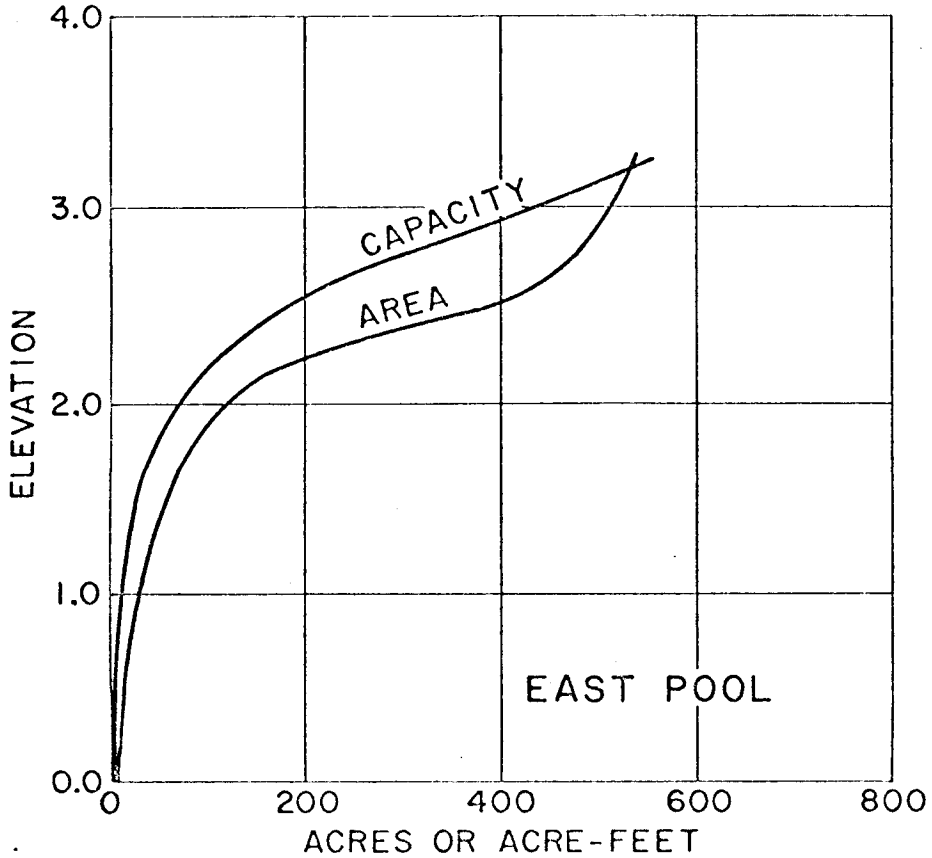
TO THE LOCAL COMMUNITY IT MEANS:

Thousands of dollars in revenue from the thousands of refuge visitors.

That 3/4 of 1% of the current value of the land within the refuge is returned to the counties each year for schools and roads.

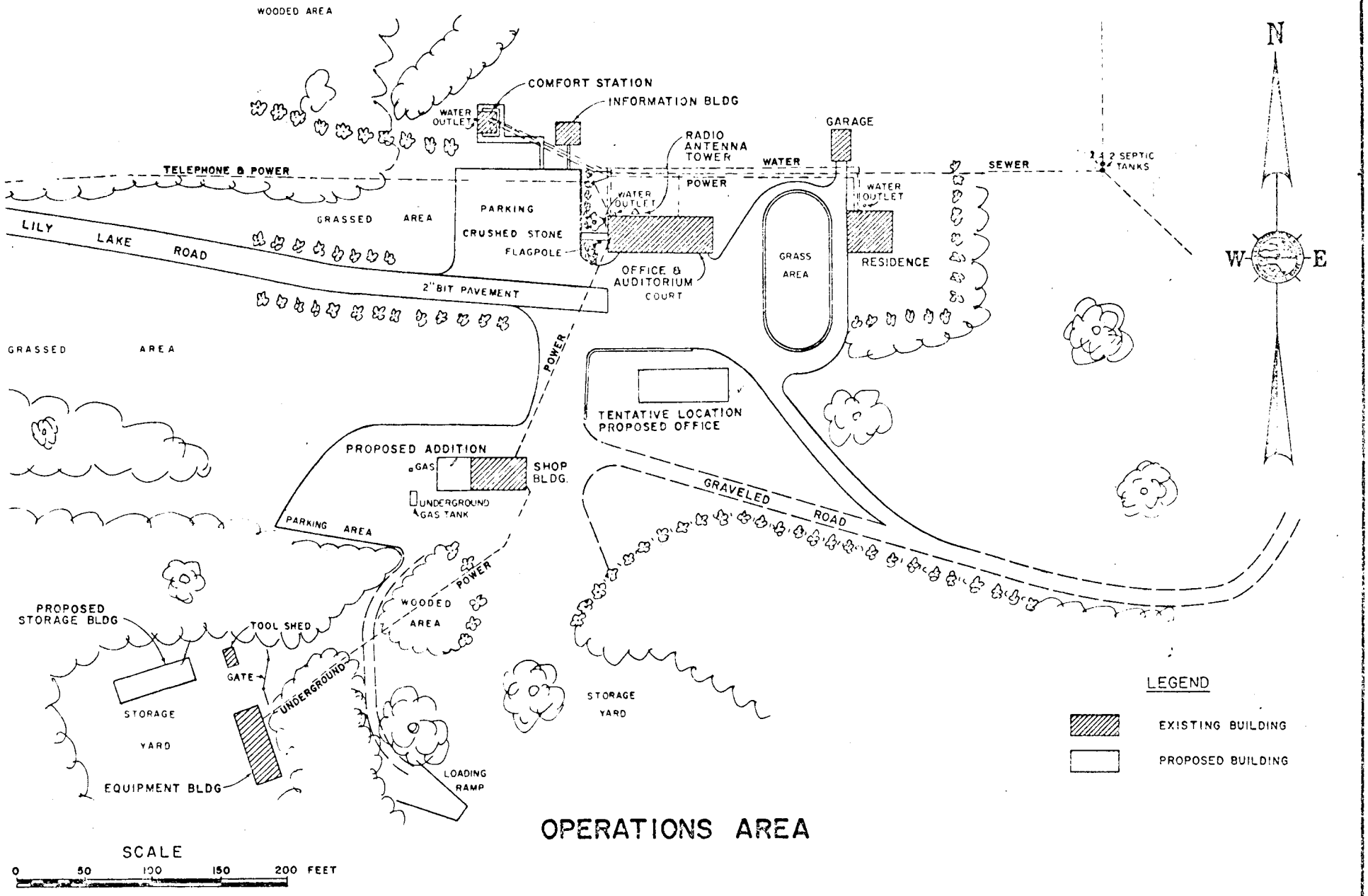
BUT TO EVERYONE IT IS A PLACE ONCE LOST IS LOST FOREVER.





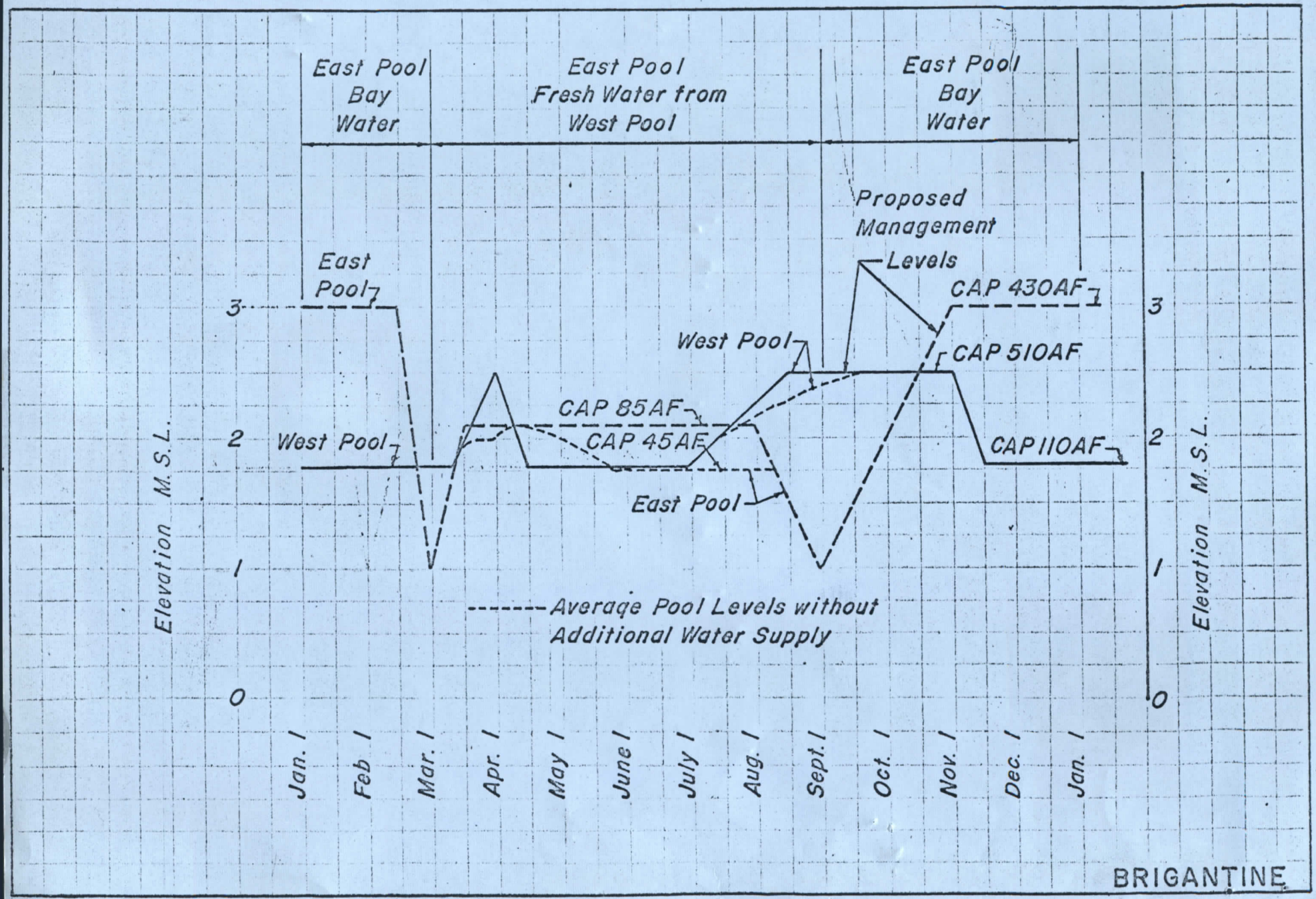
AREA-
CAPACITY
CURVES

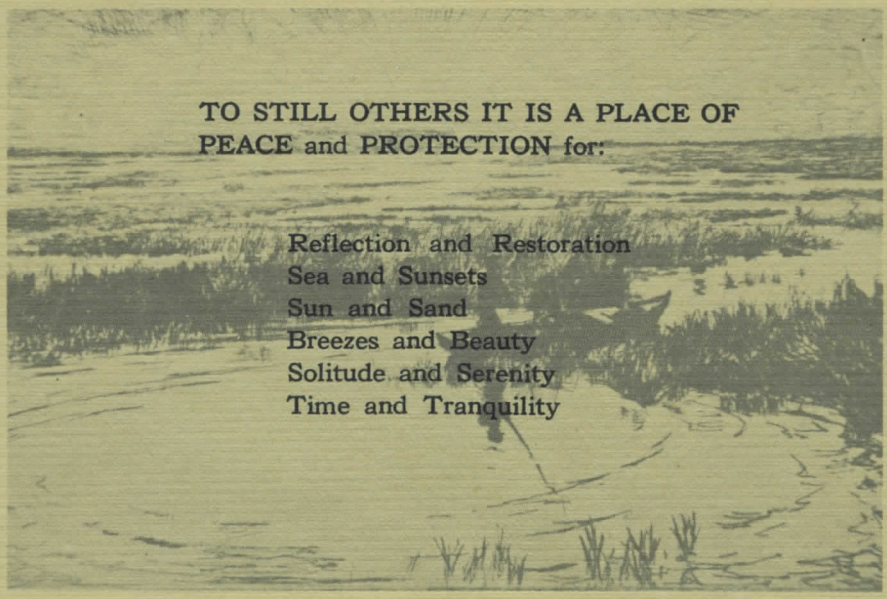
BRIGANTINE N.W.R.



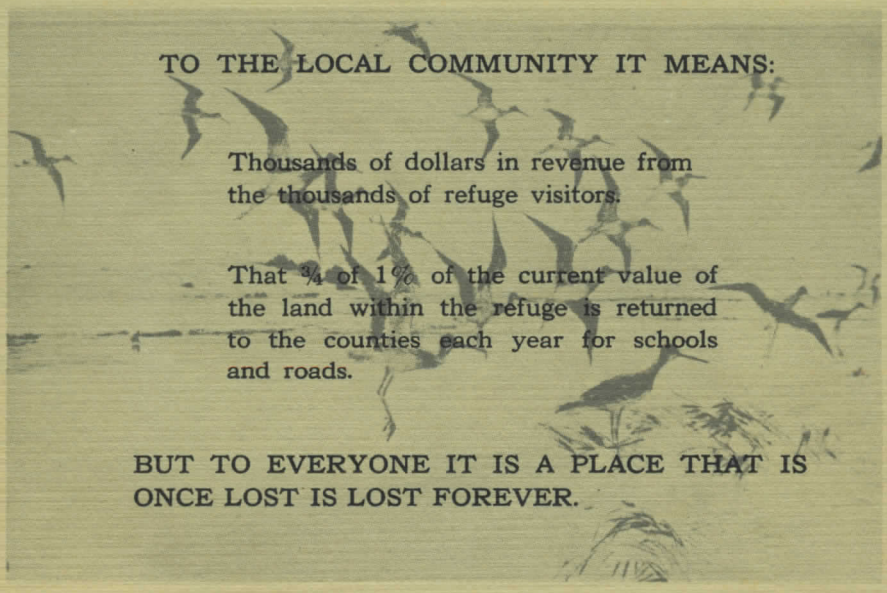
OPERATIONS AREA

BRIGANTINE N.W.R.


East Pool
Bay
Water
East Pool
Fresh Water from
West Pool
East Pool
Bay
Water
Proposed
Management
Levels
East
Pool
CAP 430AF
West Pool
CAP 510AF
CAP 85AF
West Pool
CAP 45AF
CAP 110AF
East Pool
Average Pool Levels without
Additional Water Supply
Elevation M.S.L.
3
2
1
0
Jan. 1
Feb 1
Mar. 1
Apr. 1
May 1
June 1
July 1
Aug. 1
Sept. 1
Oct. 1
Nov. 1
Dec. 1
Jan. 1
BRIGANTINE



Benson Etching



Benson Etching

Benson etchings used in this Plan are reprinted through the courtesy of the Benson Trust and the Massachusetts Audubon Society.

This administrative plan proposed and prepared by the Bureau of Sport Fisheries and Wildlife's Northeastern Region, Boston, Massachusetts, supports and furthers the high objectives of the Department of the Interior for the wise development, management and use of the lands, waters, and other resources of the National Wildlife Refuge System.

Richard E. Griffith
Regional Director

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."
The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

February 1971